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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATBnorms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

ED 059295

S-17R

June 1970

U.S. Training and
Employment Service
Technical Report
S-17R

Development of USTES

APTITUDE TEST
BATTERY FOR

PRESSMAN

(rubber goods; rubber tire & tube)
559.885

**PRESSMAN,
O-RINGS**

(rubber goods)
559.885

U.S. DEPARTMENT OF LABOR
Manpower Administration

TM 001 186

Technical Report on Development of USTES Aptitude Test Battery

for . . . . . .

Pressman (rubber goods, rubber tire and tube) 559.885-230
Pressman, O-Rings (rubber goods) 559.885-232
S-17R

(Developed in Cooperation with the Ohio
State Employment Service)

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U.S. DEPARTMENT OF LABOR
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB #2789, 577

DEVELOPMENT OF USTES APTITUDE TEST BATTERY

For

Pressman (rubber goods, rubber tire & tube) 559.885-230
Pressman, O-Rings (rubber goods) 559.885-232

S-17R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Pressman (rubber goods) 559.885-230. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
P - Form Perception	80
M - Manual Dexterity	85

RESEARCH SUMMARY

Sample:

64 male workers employed as Pressman by a rubber company in Ohio. All individuals in the sample were non-minority group members.

Criterion:

Supervisory ratings.

Design:

Longitudinal (test data was collected December 4, 1957, to March 25, 1969, and criterion data was collected November 26, 1968, through October 8, 1969.)

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Predictive Validity:

Phi Coefficient = .26 ($P/2 < .025$)

Effectiveness of Norms:

Only 67% of the non-test-selected workers used for the study were good workers; if the workers had been test-selected with the above norms, 74% would have been good workers. 33% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 26% would have been poor workers. The effectiveness of the norms is shown graphically in Table I.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	67%	74%
Poor Workers	33%	26%

SAMPLE DESCRIPTION

Size:

N = 64

Occupational Status:

Employed Workers

Work Setting:

Workers were employed at a rubber company in Ohio

Employer Selection Requirements:

Education: Prefer high school graduate.

Previous Experience: 30 days to 3 months experience.

Tests: SRA nonverbal. Although the employer used the previous S-17 battery as a screening device, an analysis of the scores of individuals in this occupation indicated that 20% or more failed to meet the requirements of the battery. Therefore, it was felt that this did not constitute significant sample pre-selection.

Other: Minimum height of 5'6" with proportionate weight
Minimum age of 18 years
Complete physical examination with back X-ray
No color blindness
Interview

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the appendix.

Minimum Experience:

All workers in the sample had completed 45 days on-the-job training.

TABLE 2

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience.

	Mean	SD	Range	r
Age (years)	28.3	7.5	19-61	.417*
Education (years)	11.4	1.1	8-13	-.086
Experience (months)	36.1	50.7	4-338	.453*

* Significant at the .001 level

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002A were administered during December 4, 1957, through March 25, 1969.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made during November 26, 1968, through October 8, 1969. The ratings were made by first-line supervisors.

Rating Scale:

USES Form SP-21, "Descriptive Rating Scale," and a set of special items were used for rating the workers. The special items were developed to measure performance on specific aspects of the job which were identified by the supervisors as being important. The entire scale (see Appendix) contained sixteen items with five alternatives for each item. The alternatives indicate the different degrees of job proficiency.

Reliability:

The correlation between the two ratings was .85, indicating a significant relationship. Therefore, the final criterion consisted of the combined scores of the two sets of ratings.

Criterion Score Distribution:

Possible Range:	32-160
Actual Range:	89-140
Mean:	120.2
Standard Deviation:	10.6

Criterion Dichotomy:

The criterion distribution was dicothomized into low and high groups by placing 33% of the sample in the low criterion group to correspond with the percentage of workers considered to be unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 117.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes G and M which did not have significant correlations with the criterion were considered for inclusion in the norms because the sample had relatively high means and relatively low standard deviations on these aptitudes. With employed workers a relatively high mean score and a relatively low standard deviation may indicate some sample pre-selection has taken place. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis

(Based on the job analysis, the aptitudes indicated appear to be important to the work performed.)

Aptitude	Rationale
G - General Learning Ability	Required to read schedule, record appropriate data on Press Sheet, plan time cycle for machines, and learn and follow instructions explicitly.
K - Motor Coordination	Required to install rings in die openings, operate press, set valves and other controls, and remove material from dies, all within specified time cycle.
M - Manual Dexterity	Required to load materials into press by hand; uses knife or sharp instrument to remove rind or flash from finished material.

TABLE 4

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 64.

Aptitudes	Mean	SD	Range	r
G - General Learning Ability	102.6	15.0	63-138	.123
V - Verbal Aptitude	94.5	14.1	68-127	.019
N - Numerical Aptitude	103.6	17.4	57-140	.066
S - Spatial Aptitude	104.2	16.9	61-140	.158
P - Form Perception	102.3	17.8	51-152	.286*
Q - Clerical Perception	99.6	13.2	61-129	.214
K - Motor Coordination	97.8	15.4	62-132	.000
F - Finger Dexterity	95.3	17.2	46-133	-.058
M - Manual Dexterity	108.6	18.5	65-152	.000

* Significant at the .05 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X						X		X
Irrelevant									
Relatively High Mean	X		X	X					X
Relatively Low Standard Dev.		X				X			
Significant Correlation With Criterion					X				
Aptitudes to be Considered for Trial Norms	G				P				M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of Aptitudes G, P, and M at trial cutting scores were able to differentiate between 67% of the sample considered good workers and 33% of the sample considered poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample; for four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. The optimum differentiation for the occupation of Pressman (rubber goods) 559.885-230 was provided by norms of **P-80 and M-85. The validity** of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .26 (statistically significant at the .025 level).

TABLE 6

Predictive Validity of Test Norms, P-80 and M-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	4	39	43
Poor Workers	7	14	21
Total	11	53	64

Phi Coefficient (ϕ) = .26 Chi Square (X^2_y) = 4.2
Significance Level = P/2 < .025

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-56 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .35 is obtained with the OAP-56 norms of P-75, F-80 and M-80 when applied to the cross-validation study only.

CHECK STUDY RESEARCH SUMMARY SHEET

S-17R

GATB #577

Pressmen, O-Rings (rubber goods) 559.885-232

Check Study #1 Research Summary

Sample:

Thirty male rubber press operators employed at the Parker Appliance Company in Cleveland, Ohio. This study was conducted prior to the requirement of providing minority group composition. Therefore, minority group status is unknown.

TABLE 7

Means, Standard Deviations, Ranges, Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion (c^r) for Age, Education, Experience, and the Aptitudes of the GATB-Cross-Validation Sample #1

	Mean	SD	Range	(c^r)
Age (years)	41.0	9.9	28-62	-.555
Education (years)	10.5	1.7	8-14	.426
Experience	6.8	6.6	1-24	-.115
G - General Learning Ability	98.9	16.3	56-129	.283
V - Verbal Aptitude	98.9	18.9	60-131	.092
N - Numerical Aptitude	98.3	16.0	65-128	.327
S - Spatial Aptitude	100.3	17.1	62-134	.309
P - Form Perception	89.6	11.7	66-111	.697**
Q - Clerical Perception	91.1	11.8	60-109	.424*
K - Motor Coordination	95.2	13.8	56-137	.142
F - Finger Dexterity	93.5	18.9	53-124	.430*
M - Manual Dexterity	106.0	16.0	77-143	.300

*Significant at the .05 level

**Significant at the .01 level

Criterion:

Three broad categories based on production records.

Design:

Concurrent (test and criterion data were collected at approximately the same time - August 1950).

Principal Activities:

The job duties for each worker are comparable to those shown in the Appendix.

Effectiveness of Norms:

Only 73% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-17R norms, 83% would have been good workers. 27% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-17R norms, only 17% would have been poor workers. The effectiveness of the norms is shown graphically in Table 8.

TABLE 8

Effectiveness of S-17R Norms on Check
Study #1 Norms

	Without Tests	With Tests
Good Workers	73%	83%
Poor Workers	27%	17%

TABLE 9

Concurrent Validity of S-17R Norms (P-80 and M-85)
on Check Study #1 Norms

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	2	20	22
Poor Workers	4	4	8
Total	6	24	30

Phi Coefficient ($\emptyset$) = .36
Chi Square (X^2_y) = 3.8
Significance Level = $P/2 < .025$

SP-21
Rev. 5/67

APPENDIX

UNITED STATES EMPLOYMENT SERVICE

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

SCORE_____

RATING SCALE FOR Pressman
D.O.T. Title and Code

Directions: Please read the sheet "Suggestions to Raters" and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of worker (print) _____
(Last) (First)

Sex: Male _____ Female _____

Company Job Title: Pressman (molded and extruded)

How often do you see this worker in a work situation?

____ See him at work all the time.

____ See him at work several times a day.

____ See him at work several times a week.

____ Seldom see him in work situation.

How long have you worked with him?

____ Under one month.

____ One to two months.

____ Three to five months.

____ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

1.____ Capable of very low work output. Can perform only at an unsatisfactory pace.

2.____ Capable of low work output. Can perform at a slow pace.

3.____ Capable of fair work output. Can perform at an acceptable but not fast pace.

4.____ Capable of high work output. Can perform at a fast pace.

5.____ Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

1.____ Performance is inferior and almost never meets minimum quality standards.

2.____ The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

3.____ Performance is acceptable but usually not superior in quality.

4.____ Performance is usually superior in quality.

5.____ Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

1.____ Makes very many mistakes. Work needs constant checking.

2.____ Makes frequent mistakes. Work needs more checking than is desirable.

3.____ Makes mistakes occasionally. Work needs only normal checking.

4.____ Makes few mistakes. Work seldom needs checking.

5.____ Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

1.____ Has very limited knowledge. Does not know enough to do his job adequately.

2.____ Has little knowledge. Knows enough to "get by."

3.____ Has moderate amount of knowledge. Knows enough to do fair work.

4.____ Has broad knowledge. Knows enough to do good work.

5.____ Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

1.___ Has great difficulty doing his job. Not at all suited to this kind of work.

2.___ Usually has some difficulty doing his job. Not too well suited to this kind of work.

3.___ Does his job without too much difficulty. Fairly well suited to this kind of work.

4.___ Usually does his job without difficulty. Well suited to this kind of work.

5.___ Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

1.___ Cannot perform different operations adequately.

2.___ Can perform a limited number of different operations efficiently.

3.___ Can perform several different operations with reasonable efficiency.

4.___ Can perform many different operations efficiently.

5.___ Can perform an unusually large variety of different operations efficiently.

G. How well does he handle or manipulate objects with his fingers? (Worker's ability to make fine finger movements where the hand and arm are not involved to any extent.)

1. ___ Has very great difficulty handling or manipulating objects with his fingers. Very awkward and clumsy.

2. ___ Has considerable difficulty handling or manipulating objects with his fingers. Sometimes awkward and clumsy.

3. ___ Can handle or manipulate objects with his fingers adequately.

4. ___ Has no difficulty handling or manipulating objects with his fingers. Finger movements are generally smooth,

5. ___ Does handling or manipulating with his fingers with exceptional ease and dexterity. Finger movements are very smooth and precise.

H. How well coordinated are his hand and arm movements? (Worker's ability to use hands and arms efficiently and effectively in manipulating hand tools or handling pieces of work.)

1. ___ Has very great difficulty handling tools or products. Very awkward and clumsy.

2. ___ Has considerable difficulty handling tools or products. Sometimes awkward and clumsy.

3. ___ Can handle tools or products adequately. Fairly well coordinated.

4. ___ Has no difficulty handling tools or products. Movements are generally smooth.

5. ___ Handles tools or products with exceptional ease and dexterity. Extremely well coordinated.

J. How well can he coordinate hand or foot movements with what his eye sees? (Worker's ability to make a hand or foot motion at the same time his eye sees something.)

1. ___ Is almost unable to do this. Coordination of such movements is extremely poor and erratic.

2. ___ Has considerable difficulty doing this. Coordination of such movements is not smooth.

3. ___ Can do this fairly well. Sometimes is a little awkward.

4. ___ Has no difficulty doing this. Coordination of such movements is generally smooth.

5. ___ Can do this with exceptional ease. Coordination of such movements is always very smooth.

K. How well does he coordinate the movements of his hands? (Worker's ability to perform the same or different manipulations with both hands at the same time.)

1. ___ Has very great difficulty using both hands at the same time. Very awkward and clumsy.

2. ___ Has considerable difficulty using both hands at the same time. Sometimes awkward and clumsy.

3. ___ Can perform manipulations with both hands at the same time adequately. Hand movements are fairly well coordinated.

4. ___ Has no difficulty using both hands at the same time. Movements are generally smooth.

5. ___ Uses both hands the same time with exceptional ease and dexterity. Hand movements are extremely well coordinated.

L. How well does he do the arithmetic computations required for his job? (Worker's ability to do the kind of arithmetic needed in his job.)

1. ___ Does arithmetic very poorly. Works very slowly and continually makes errors.

2. ___ Has difficulty doing arithmetic. Frequently makes errors.

3. ___ Does arithmetic fairly well. Makes errors occasionally.

4. ___ Has no difficulty doing arithmetic. Seldom makes errors.

5. ___ Does arithmetic very well. Works quickly and almost never makes an error.

M. How well can he concentrate amidst distractions? (Worker's ability to carry on his job in spite of noise or other distractions.)

1. ___ Cannot keep his mind on his work. Very easily and very often distracted.

2. ___ Distractions often keep him from concentrating on his work. Bothered considerably by distractions.

3. ___ Carries on his job fairly well in spite of distractions. Occasionally bothered by distractions.

4. ___ Distractions seldom interfere with his work. Not bothered much by distractions.

5. ___ Gives the job his complete attention in spite of distractions. Never bothered by distractions.

N. How well adapted is he for doing repetitive work? (Worker's ability to do the same operation or a very small number of tasks over and over again.)

1. ___ Is not suited for doing repetitive work. Cannot adapt himself to doing the same job over and over again.

2. ___ Has considerable difficulty performing on a repetitive job. Poorly suited for doing repetitive work.

3. ___ Can perform adequately on a repetitive job. Adapts fairly well to repetitive work.

4. ___ Has no difficulty performing on a repetitive job. Well adapted for repetitive work.

5. ___ Is exceptionally well adapted for repetitive work. Can very readily repeat the same operation all day.

O. How well does he work under unpleasant physical conditions? (Worker's ability to work amidst noise, dust, heat, fumes, or crowded conditions.)

1. ___ Has very great difficulty working under unpleasant physical conditions. Greatly bothered by noise, heat, or the like.

2. ___ Has considerable difficulty working under unpleasant physical conditions. Often bothered by noise, heat, or the like.

3. ___ Can work fairly well under unpleasant physical conditions.— Occasionally bothered by noise, heat, or the like.

4. ___ Has no difficulty working under unpleasant physical conditions. Seldom bothered by noise, heat, or the like.

5. ___ Can work very well under unpleasant physical conditions. Is not bothered at all by noise, heat, or the like.

P. How well adapted is he for inside work? (Worker's ability to work indoors.)

1. ___ Has very great difficulty working indoors. Not adapted for inside work. Definitely does not like working inside.

2. ___ Has considerable difficulty working indoors. Somewhat dislikes inside work.

3. ___ Can work fairly well inside. Is satisfied working indoors.

4. ___ Performs well indoors. Likes working inside.

5. ___ Works best indoors. Definitely prefers inside work.

Q. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-around ability" to do his job.)

1. ___ Would be better off without him. Performance usually not acceptable.

2. ___ Of limited value to the organization. Performance somewhat inferior.

3. ___ A fairly proficient worker. Performance generally acceptable.

4. ___ A valuable worker. Performance is usually superior.

5. ___ An unusually competent worker. Performance almost always top notch.

June 1970 FACT SHEET S-17R

Job Title:

Pressman (rubber goods, rubber tire & tube) 559.885-230

Job Summary:

Tends as many as nine different types of molding presses, loading and unloading on a planned, timed cycle, in the forming of heavy duty rubber and rubber/metal parts for automobiles as well as military tanks and farm equipment.

Work Performed:

Sprays inner surface of mold with lubricant to prevent rubber from sticking. Positions preform rubber, half-shells, or cores in mold cavities or on lower die and places upper die over rubber. May insert metal parts in mold cavities to join with rubber during process. Closes mold. Closes and starts press. Sets timer for specified curing time. Bumps the required number of times. Pulls mold from press and strips articles from mold. Blows granules of rubber from top die with air nozzle. Removes flash by peeling off while rubber is soft, or using rubber knife.

Job Title:

Pressman, O-Rings (rubber goods) 559.885-232

Work Performed:

Places uncured slugs in two molds: Examines job ticket and color identification on the slugs and picks up raw slugs from metal tray on workbench; places slugs compactly into mold cavities so that top part of hinged mold closes directly on uncured slug. May be required to stretch continuous slug in order to fit into specified mold cavity. Lowers hinged mold top to closing position with or without use of Electric Hoist.

Operates presses to cure and convert slugs into O-rings: Pushes light molds forward on rollers between platens of press, pushes heavier molds on Carriage to the right and then into press; presses button at lower right of press to engage press. Ordinarily, bounces Press two times to replace air in mold cavities with rubber. Prepares second press for operation while observing excessive deviation of temperature from normal 320°F and noticing other malfunctions in first press.

Removes mold from press: After automatic press disengages itself and opens, pulls heavy mold backward on Carriage, then to left; operates Electric Hoist to lift hinged top of mold or lifts top of mold with hands; pulls small mold from press and lifts hinged top with hand. Makes certain that hinged tops of molds are secure at open position.

Removes cured O-rings from mold cavities: Directs pressure from air hose into mold cavities with one hand, catches small O-rings on Wire pick and larger O-rings with gloved other hand, taking precautions to prevent contact with the hot mold cavities (320°F). Places O-rings in metal tray on bench. Cleans cavities by directing air pressure from air hose into mold cavities. Reloads cavities with uncured slugs for next operation.

Removes flash and inspects O-rings: Picks up cured O-ring from Tray, removes flash with left hand, puts flash in Container at left and O-ring in Container at right. Inspects stripped O-ring for obvious flaws such as non-fills, foreign material (dirt and plastics), lays defective O-rings aside on bench. Completes job ticket and places in Container with inspected O-rings.

Effectiveness of Norms: (Validation)

Only 67% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-17R norms, 74% would have been good workers. 33% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-17R norms, only 26% would have been poor workers.

Effectiveness of Norms: (Cross-Validation #1)

Only 73% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-17R norms, 83% would have been good workers. 27% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-17R norms, only 17% would have been poor workers.

Applicability of S-17R Norms:

The aptitude test battery is applicable to jobs which include a majority of the job duties described above.

GPO 898.732

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